

volatile component rich vapor phase, part of the less volatile component transferring from the fluid mixture to the liquid phase to form a less volatile component rich liquid phase.

[0011] In one embodiment, the invention relates to a process for distilling a fluid mixture in a microchannel distillation assembly, the microchannel distillation assembly comprising at least one, and in one embodiment, a plurality of microchannel distillation units, each microchannel distillation unit comprising a plurality of microchannel distillation sections, each of the microchannel distillation units having a feed inlet, a distillate end, and a bottoms end, the fluid mixture comprising a more volatile component and a less volatile component, the process comprising:

[0012] flowing a vapor phase through each of the microchannel distillation units towards the distillate end of each of the microchannel distillation units;

[0013] flowing a liquid phase through each of the microchannel distillation units towards the bottoms end of each of the microchannel distillation units;

[0014] flowing the fluid mixture through the feed inlet of each of the microchannel distillation units into at least one microchannel distillation section within each of the microchannel distillation units, part of the more volatile component transferring from the fluid mixture to the vapor phase to form a more volatile component rich vapor phase, part of the less volatile component transferring from the fluid mixture to the liquid phase to form a less volatile component rich liquid phase;

[0015] flowing the more volatile component rich vapor phase through a plurality of the microchannel distillation sections in each microchannel distillation unit towards the distillate end of each microchannel distillation unit, the more volatile component rich vapor phase contacting the liquid phase in each microchannel distillation section and becoming enriched with the more volatile component;

[0016] flowing the less volatile component rich liquid phase through a plurality of the microchannel distillation sections in each microchannel distillation unit towards the bottoms end of each microchannel distillation unit, the less volatile component rich vapor liquid phase contacting the vapor phase in each microchannel distillation section and becoming enriched with the less volatile component.

[0017] In one embodiment, the invention relates to a process for distilling a fluid mixture in a microchannel distillation assembly, the microchannel distillation assembly comprising at least one microchannel distillation unit, the microchannel distillation unit comprising a plurality of microchannel distillation sections, the microchannel distillation unit having a feed inlet, a distillate end, and a bottoms end, the fluid mixture comprising a more volatile component and a less volatile component, the process comprising:

[0018] flowing a vapor phase through the microchannel distillation unit towards the distillate end of the microchannel distillation unit;

[0019] flowing a liquid phase through the microchannel distillation unit towards the bottoms end of the microchannel distillation unit;

[0020] flowing the fluid mixture through the feed inlet for the microchannel distillation unit into at least one micro-

channel distillation section within the microchannel distillation unit, part of the more volatile component transferring from the fluid mixture to the vapor phase to form a more volatile component rich vapor phase, part of the less volatile component transferring from the fluid mixture to the liquid phase to form a less volatile component rich liquid phase;

[0021] flowing the more volatile component rich vapor phase through a plurality of the microchannel distillation sections in the microchannel distillation unit towards the distillate end of the microchannel distillation unit, the more volatile component rich vapor phase contacting the liquid phase in each microchannel distillation section and becoming enriched with the more volatile component;

[0022] flowing the less volatile component rich liquid phase through a plurality of the microchannel distillation sections in the microchannel distillation unit towards the bottoms end of each microchannel distillation unit, the less volatile component rich vapor liquid phase contacting the vapor phase in each microchannel distillation section and becoming enriched with the less volatile component.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0023] In the annexed drawings, like parts and features have like designations.

[0024] FIG. 1 is a schematic illustration of a distillation process using a microchannel distillation assembly in accordance with the invention.

[0025] FIG. 2 is a schematic illustration of an alternate embodiment of a distillation process using a microchannel distillation assembly in accordance with the invention.

[0026] FIG. 3 is a schematic illustration of another alternate embodiment of a distillation process using a microchannel distillation assembly in accordance with the invention.

[0027] FIG. 4 is a three-dimensional exterior schematic illustration of the microchannel distillation assembly illustrated in FIG. 2.

[0028] FIG. 5 is an end view of the microchannel distillation assembly illustrated in FIG. 4.

[0029] FIG. 6 is a schematic illustration of an alternate embodiment of the microchannel distillation assembly illustrated in FIG. 4.

[0030] FIG. 7 is a schematic illustration of a distillation process using two microchannel distillation assemblies in accordance with the invention, one of the microchannel distillation assemblies being downstream from the other microchannel distillation assembly.

[0031] FIG. 8 is a schematic illustration of an alternate embodiment of a distillation process using two microchannel distillation assemblies in accordance with the invention, one of the microchannel distillation assemblies being downstream from the other microchannel distillation assembly.

[0032] FIG. 9 is a schematic illustration of a distillation process using six microchannel distillation assemblies in accordance with the invention, two of the microchannel distillation assemblies being downstream from a first microchannel distillation assembly, and three of the microchannel